

CAMAC MODEL 2551

12-CHANNEL  
100 MHz SCALER

March, 1983

## WARRANTY

LeCROY CORPORATION warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 1 year from the date of purchase. Custom monolithics and hybrids sold separately and all spare or replacement parts and repairs are warranted for 90 days. This warranty extends only to the original purchaser and shall not apply to fuses, disposable batteries, or any product or parts which have been subject to misuse, neglect, accident or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, LeCroy will repair and calibrate an instrument returned to the factory or an authorized service facility within one year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within one year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions or operations, repairs will be billed at a nominal cost. In such cases, an estimate will be submitted before work is started, if requested.

The foregoing warranty is in lieu of all other warranties, express or implied, including but not limited to any implied warranty of merchantability, fitness, or adequacy for any particular purpose or use. LeCroy Corporation shall not be liable for any special, incidental, or consequential damages, whether in contract, tort or otherwise.

IF ANY FAILURE OCCURS, notify LeCroy Corporation or the nearest service facility, giving full details of the difficulty, and include the Model number, serial number, and FAN (Final Assembly Number) or ECO (Engineering Change Order) number. On receipt of this information, service data or shipping instructions, forward the instrument, transportation prepaid. A Return Authorization Number will be given as part of shipping instructions. Marking this RA number on the outside of the package will insure that it goes directly to the proper department within LeCroy. Repairs will be made at the service facility and the instrument returned transportation prepaid.

ALL SHIPMENTS OF LECROY INSTRUMENTS FOR REPAIR OR ADJUSTMENT should be made via Air Freight or "Best Way" prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

A T T E N T I O N

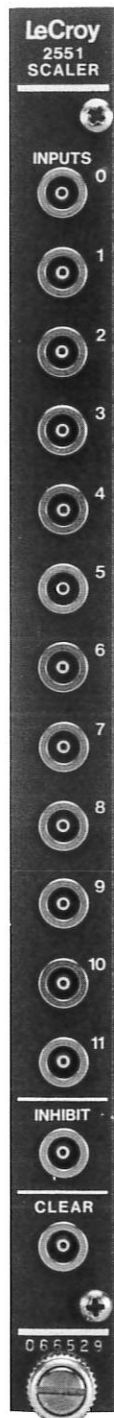
SEE POCKET IN BACK OF MANUAL FOR SCHEMATICS,  
PARTS LISTS, AND ADDITIONAL ADDENDA WITH ANY  
CHANGES TO MANUAL.

CRATE POWER SHOULD BE TURNED OFF DURING  
INSERTION AND REMOVAL OF UNIT TO AVOID DAMAGE  
CAUSED BY MOMENTARY MISALIGNMENT OF CONTACTS.

A T T E N T I O N

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## CAMAC Model 2551 12 Channel Scaler

- **Compact packaging**—12 channels per single-width module means fewer crates, smaller systems, less inhibit fan-out.
- **Low cost**—The high density hybrid circuit design allow common functions to serve a greater number of channels, thus lowering the cost per channel.
- **Fast clear input**—Enables fast rejection of unwanted data without dataway operations.
- **Less than 10 ns double-pulse resolution**—100 MHz counting rates.
- **Direct-coupled inputs**—Input sensitivity or rate capability are not dependent upon risetime.
- **Input inhibit**—Common inhibit disables inputs without injecting counts.
- **Test mode**—Increment mode permits testing all scalers simultaneously without removing cables.
- **Full LAM functions**—Signals impending overflow condition.
- **Full provision to cascade channels**—provides > 24-bit capacity when needed.

The LRS Model 2551 contains 12 identical 24-bit binary scalers especially designed for use in high-speed nuclear counting applications. This dramatic increase in channel density over conventional 4-channel designs is made possible by state-of-the art hybrid circuits which offer reliability-enhancing low power dissipation in addition to compact packaging.

Each scaler is equipped with an extremely wideband input circuit which responds to NIM level logic signals of any duration down to 5 ns, without multiple-pulsing (in the case of wide inputs) and without counting down. The ability to recognize narrow input signals at an equivalent rate of >100 MHz is an important feature, since it assures that the scaler will accurately accumulate any output signal generated by standard discriminator and logic circuits.

Each module is provided with a high-speed fast inhibit which permits simultaneous rejection of input signals at a rate equivalent to 100 MHz. The CAMAC Inhibit (I) provides inhibit control via the rear connector. The inhibit signal must overlap the input signal, but toggling the inhibit will not cause pulses to be counted.

Fast rejection of unwanted data is provided by the fast clear input. This input allows the entire scaler to be reset by application of a NIM level clear pulse without the need to perform any dataway operations.

The Model 2551 provides a full set of LAM functions. When enabled, setting of the 24th bit of any of the 12 channels is flagged by generation of LAM.

The Model 2551 has a built-in test circuit which allows all registers to be checked simultaneously. Application of the CAMAC Increment F(25) Function Code causes each scaler to advance by one count for each S2 timing signal received. The test circuit may be used without disconnecting cables if the Input or CAMAC I Inhibit is on. The 24-bit data from any scaler is read in parallel to the common dataway via the rear card-edge connector. Individual channel non-destructive readout is accomplished by generating a CAMAC Read F(0) and the appropriate address. Using Read and Clear F(2), the channels will be automatically zeroed after reading the last channel. Clear F(9), CAMAC Clear C, or Initialize Z will zero all channels.

The LRS Model 2551 12 Channel 100 MHz Scaler embodies refinements developed over years of experience with wideband direct-coupled discrimination and counting circuits, and, as a result, offers flexibility, reliability, and performance unmatched by any other available equipment.

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## SECTION 1

### SPECIFICATIONS

#### 1.2 Addenda to Technical Description and Specifications

1. Input Impedance: 50  $\Omega$  for negative signals; 1 K $\Omega$  for positive signal.
2. Signal Inhibit: Common input, -500 mV minimum level, 5 nsec minimum width, impedance 50  $\Omega$ . To inhibit, signal must precede input by 10 nsec. Internal inhibit interval is stretched by 5 nsec. To enable, trailing edge of inhibit must precede input by at least 15 nsec.
3. (F(25)): To operate properly, all A(0) to A(11) channels should be cleared prior to the first application of F(25). The unit should be inhibited to prevent input pulses from being counted.
4. Cascading of Channels: By internal wire jumper option (see section 1.5), each even-numbered channel (i.e., 0, 2, 4, 6, 8, 10) may be cascaded with the subsequent or any odd numbered channel to provide one 48-bit (or 32 bit) scaler. A LAM is generated when the half scale is set.

#### 1.3 Initializing

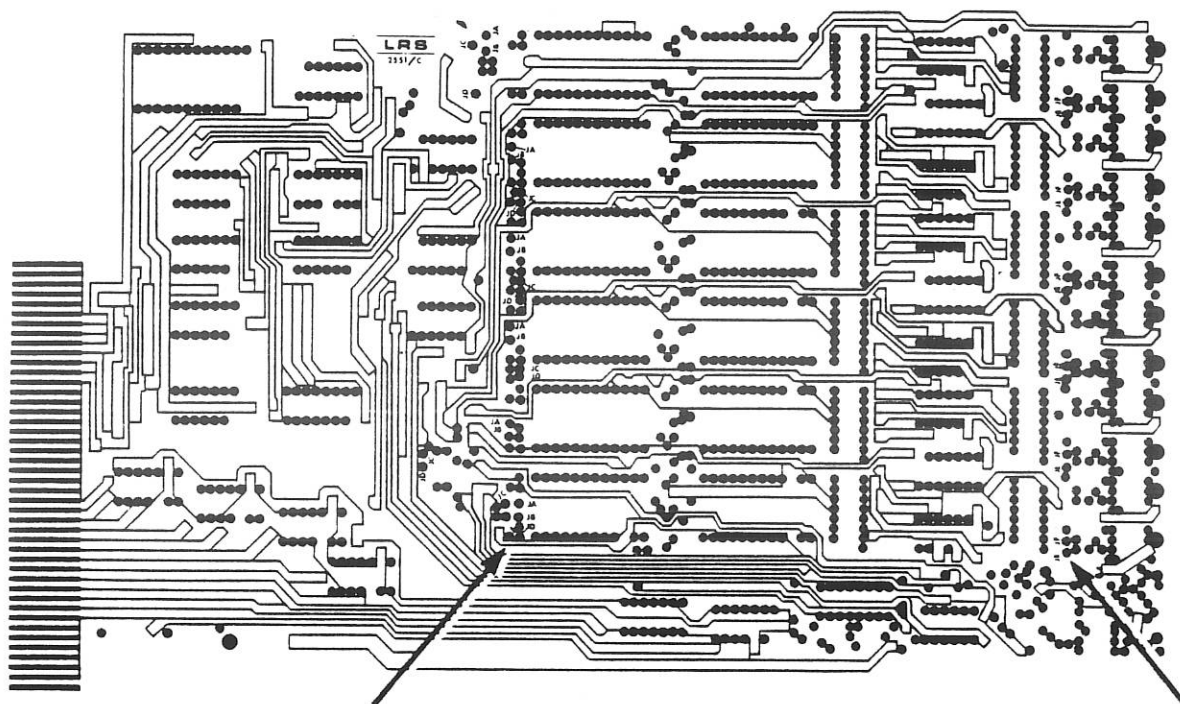
Upon power turn-on, a CAMAC Z should be generated. This will assure that all scalers, the overflow latch, and LAM enable flop have all been cleared.

#### 1.4 The Fast Inhibit

In order to use the fast inhibit effectively, it must precede the input pulse to be inhibited by a minimum of 10 nsec. Failure to allow for this delay might allow unwanted pulses to be counted. The trailing edge of the inhibit pulse must precede the leading edge of the input pulse by a minimum of 15 nsec to allow the input to be counted.

#### 1.5 Cascading Channels

(See board layout Figure 1.1). To cascade two channels (i.e., to obtain 48 bits), the jumper from JA to JB on the even channel which is to contain the 24 bits must be removed and connected from JA to JD. The jumper between JF and JE on the odd channels must also be removed. To complete the option, point JC of the first channel should be connected to point JE of the second by a hard wire jumper. When cascading, any two channels may be selected. They do not have to be consecutive. The only requirement is that an even-numbered channel is



AREAS OF MODIFICATION FOR EXAMPLE CASCADING

Figure 1.1

## SECTION 2

### FUNCTIONAL DESCRIPTION

The Model 2551 consists of twelve 24-bit scaler channels and associated control circuitry. Referring to the block diagram (Figure 2.1), the Model 2551 circuitry is seen to be divided into four basic parts:

The twelve Scaler channels.

The Inhibit circuit.

The Clear, Increment and LAM Logic.

A CAMAC Control and Address section.

Each of the above parts will be discussed briefly.

#### 2.1 The 12 Scaler Channels

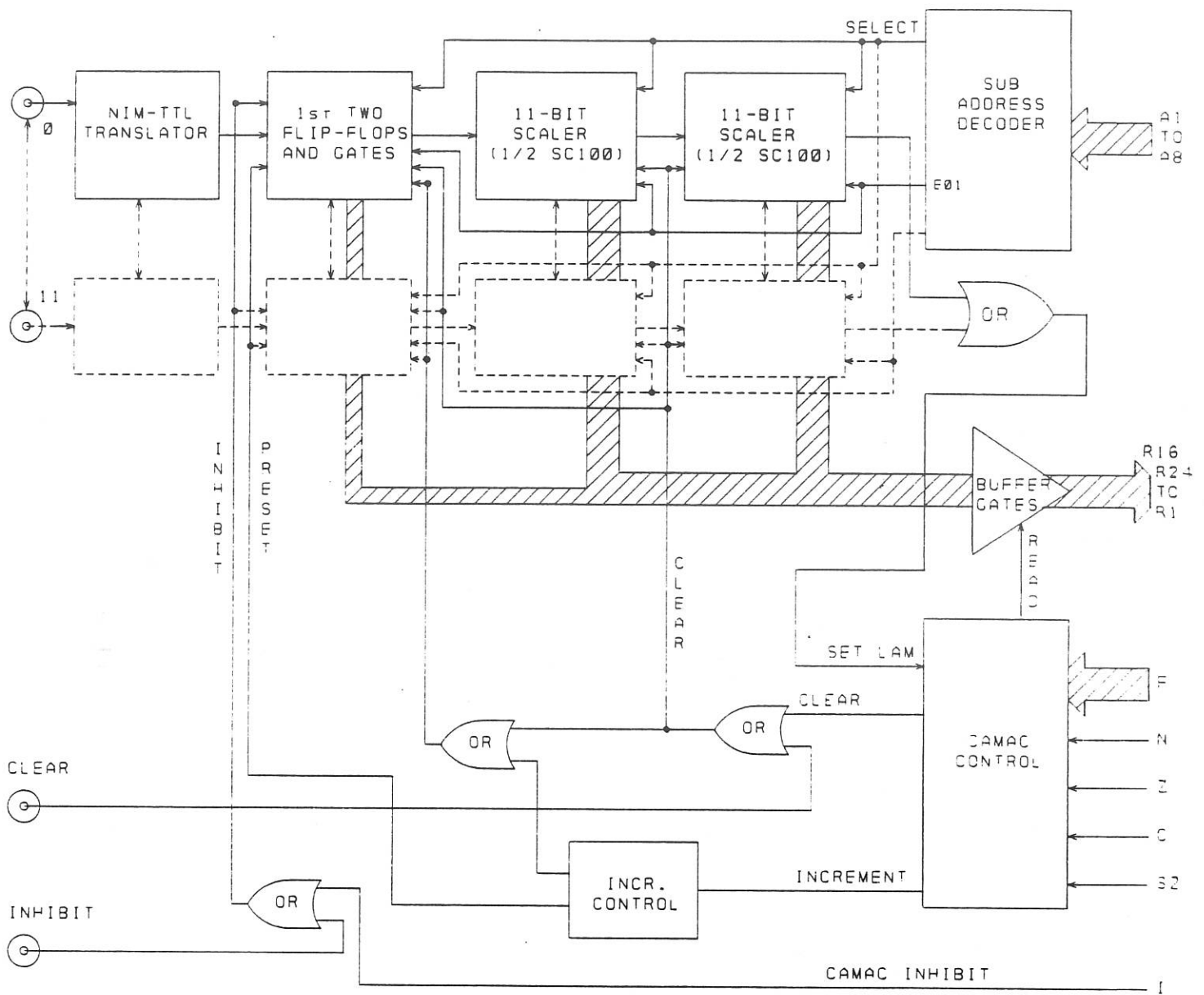
Each scaler channel is made up of an input translator stage, two high speed flip-flops and two halves of two dual scaler hybrids. The input translator is a common base stage used to convert the NIM pulses to TTL level. This is followed by two J-K flip-flops which divide the input rate by 4 to a maximum of 25 MHz acceptable by the SC100 hybrid scalers. Each hybrid scaler contains two parallel scalers and a common tri-state multiplexer. Each scaler channel uses half each of two hybrids connected in series. The first scaler hybrid is a SC-100 dual 11 bit scaler whose 11th bit supplies an output pulse via an emitter follower to a second SC-100 this second hybrid provides the remaining 11 bits of the 24 bit channel. The 11th bit of this hybrid drives the overflow OR gate consisting of twelve emitter followers, one for each channel, with their emitters tied common.

As a user option, the output of the last bit of any even-numbered channel can be tied back to the next (odd-numbered) channel's first J-K flip-flop inputs. This connection provides for a single 48-bit scaler channel.

In the 2551 module only one channel can be strobed at a time. The first two J-K flip-flops each require separate open collector gates with the outputs tied common and inverted to become the two least significant bits of the output gates.

The multiplexer in each SC100 has a tri-state output permitting all bits of equal power to be connected directly together (i.e., all  $2^3$  bits are common, all  $2^4$  bits are common, etc.). The states of the enable and select lines determine the channel to be read out. Each SC100 has one enable and one select line. The enable line strobes the SC100 to read out, and the select line determines which of the two channels in the selected SC100 is to be read out. To use the same control lines, two NOR gates are connected in such a way so as to convert the select and enable to two independent strobe lines.





BLOCK DIAGRAM - 2551

Figure 2.1

## AN-4

### A SIMPLE TIMING SCHEME USING A CAMAC GATE GENERATOR AND SCALER

The LeCroy Models 222 and 2551 may be used together to form a time digitizer capable of 20 nsec resolution for times as long as 200 msec. If a signal is applied to the start input of the Model 222 and a second signal is applied to the stop input, the Model 222 puts out a gate pulse of duration equal to the time between the start and the stop input pulses or the preset gate time, whichever is smaller. In this way, a gate equal to the time of interest is generated with a provision for overflow. This feature is often necessary when no stop pulses are to be expected.

The blanking input of the Model 222 sets the output of the module to a logical zero state for the duration of the blanking signal. The minimum pulse width to which the blanking input will respond is 10 nsec thus a 50 MHz clock may be applied to this input. In this case, the output of the Model 222 when used as described above will be a 50 MHz pulse train for the duration of the time to be measured. These pulses may be counted by a LeCroy Model 2551 or 2552 12-channel CAMAC scaler.

Such a system consisting of 1 Model 2551 and 12 Model 222's may be used for a variety of applications including neutron time-to-flight spectroscopy. The common start (stop) signals and the clock signals may be fanned out using a Model 429A in the 2 x 8 mode.

## REPLACEMENT PARTS

MODEL NO 2551  
ECOR 1003  
MCN 1

## 12-CHANNEL SCALER

PRINTED 27-Feb-86  
REV DATE 15-May-80  
MCN DATE 18-Oct-83

LeCROY PART NO			DESCRIPTION						
102	245	103	CAP CERA DISC 25V	.01 U	PT-FDCL-1/32	LEADS 3/8	AWG 22		
102	444	560	CAP CERA DISC 100V	56 F	10% S3N				
102	944	075	CAP CERA DISC 1KV	7.5 F	10% S2L				
103	327	103	CAP CERA MONO 50V	.01 U	20% GEN	FURP/LEADS FULL LENGTH			
142	824	685	CAP TANT DIP CASE	6.8 U	35V 20%	.256 X .374			
161	225	112	RES CARBON FILM	1.1	1/8W 5%				
161	225	510	RES CARBON FILM	51 OHM	1/8W 5%				
161	225	512	RES CARBON FILM	5.1	1/8W 5%				
161	335	102	RES CARBON FILM	1	1/4W 5%				
161	335	112	RES CARBON FILM	1.1	1/4W 5%				
161	335	122	RES CARBON FILM	1.2	1/4W 5%				
161	335	162	RES CARBON FILM	1.6	1/4W 5%				
161	335	202	RES CARBON FILM	2	1/4W 5%				
161	335	271	RES CARBON FILM	270 OHM	1/4W 5%				
161	335	301	RES CARBON FILM	300 OHM	1/4W 5%				
161	335	332	RES CARBON FILM	3.3	1/4W 5%				
161	335	361	RES CARBON FILM	360 OHM	1/4W 5%				
161	335	391	RES CARBON FILM	390 OHM	1/4W 5%				
161	335	430	RES CARBON FILM	43 OHM	1/4W 5%				
161	335	433	RES CARBON FILM	43	1/4W 5%				
161	335	510	RES CARBON FILM	51 OHM	1/4W 5%				
161	335	511	RES CARBON FILM	510 OHM	1/4W 5%				
161	335	512	RES CARBON FILM	5.1	1/4W 5%				
161	335	560	RES CARBON FILM	56 OHM	1/4W 5%				
161	335	621	RES CARBON FILM	620 OHM	1/4W 5%				
161	335	751	RES CARBON FILM	750 OHM	1/4W 5%				
161	335	821	RES CARBON FILM	820 OHM	1/4W 5%				
161	335	911	RES CARBON FILM	910 OHM	1/4W 5%				
161	445	510	RES CARBON FILM	51 OHM	1/2W 5%				
200	031	002	IC 2-INPUT NAND	SN7401	DIP-14/QUAD	PKG/OPEN COLL	7401		
200	031	012	IC J-K FLOP	SN74L73	DIP-14/DUAL	PKG	74L73		
200	031	022	IC 2-INPUT NAND	SN7437	DIP-14/QUAD	PKG/TOTEM-POLE	7437		
200	031	028	IC 2-INPUT NAND	SN74LS00	DIP-14		74LS00		
200	031	046	IC HEX INVERTER	SN74LS04	DIP-14		74LS04		
200	031	047	IC 3-INPUT NAND	SN74LS10	DIP-14/TRIPLE	PKG	74LS10		
200	031	050	IC 2-INPUT NAND	SN74LS01	DIP-14/QUAD	PKG/OPEN COLL	74LS01		
200	031	051	IC 2-INPUT NOR	SN74LS02	DIP-14/QUAD	PKG	74LS02		
200	031	052	IC 8-INPUT NAND	SN74LS30	DIP-14/SINGLE	PKG	74LS30		
200	041	001	IC DECODER	SN7442	DIP-16/4-TO-10-LINE		7442		
200	041	008	IC J-K FLOP	SN74S112	DIP-16/DUAL	PKG/EDGE-TRIG	74S112		
200	042	003	IC MULTIVIBRATOR	96L02P	DIP-16/DUAL	PKG/RESETTABL	96L02		
200	081	004	IC DECODER/DEM	DM74LS154	DIP-24		74LS154		
210	080	001	IC 11-BIT SCALER	SC10	DUAL	PKG/DIP-24	PL:SC100		
230	110	003	DIODE SWITCHING	FD 77					
230	110	005	DIODE SWITCHING	1N444					
235	050	001	DIODE RECTIFIER	1N413					
253	010	835	DIODE HOT CARRIER	HP283	H-P CASE 15				

## REPLACEMENT PARTS

MODEL NO 2551  
 ECOM 1003  
 MCN 1

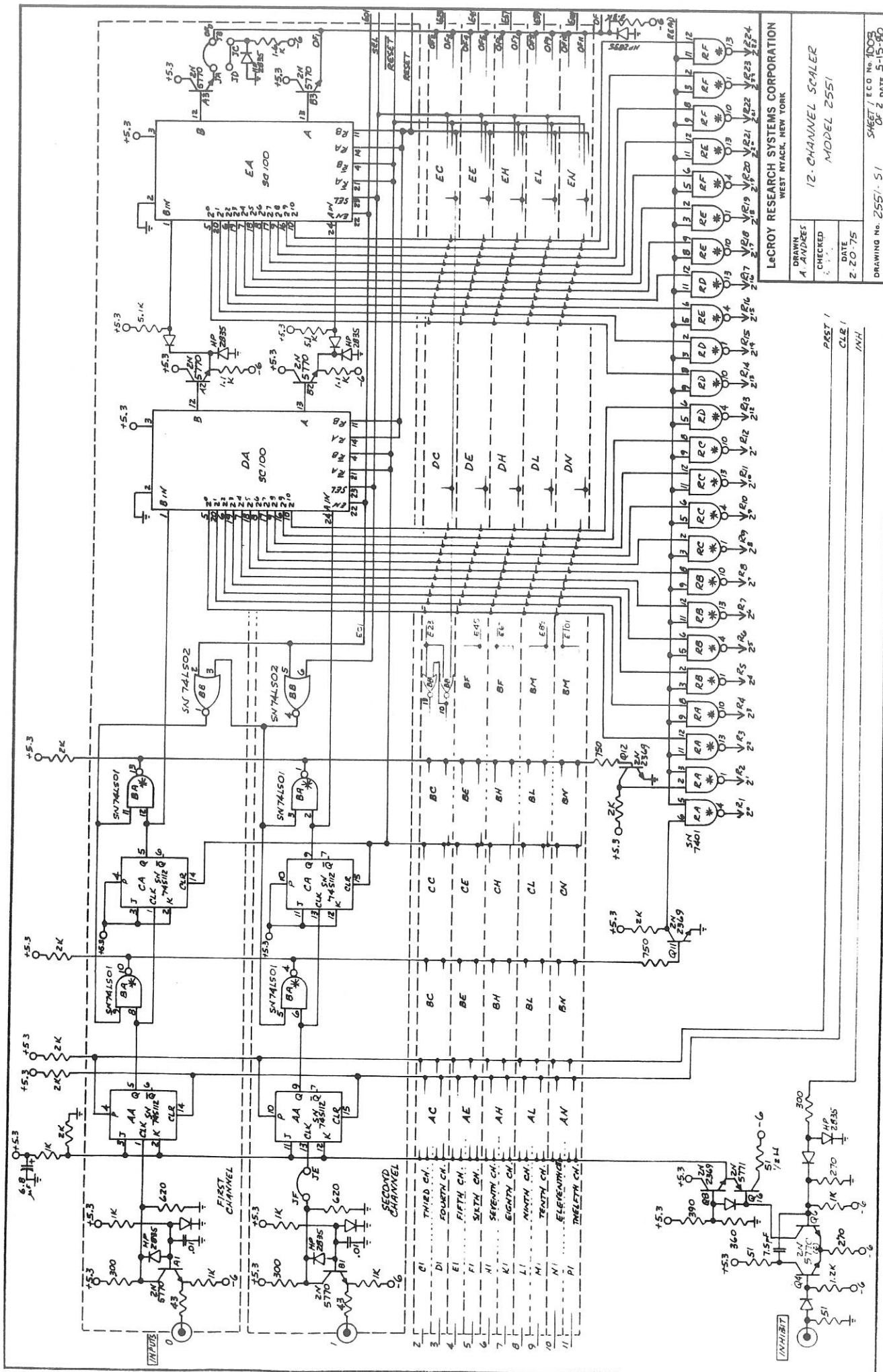
12-CHANNEL SCALER

PRINTED 27-Feb-86  
 REV DATE 15-May-80  
 MCN DATE 18-Oct-83

LeCROY PART NO

DESCRIPTION

270	110	001	TRANSISTOR NPN	PR2369	10-92 CASE (PLASTIC)
270	170	001	TRANSISTOR NPN	2N577	10-92
275	170	002	TRANSISTOR PNP	2N577	10-92
300	050	001	CHOKE FERRITE SINGLE LEA		
400	020	014	SOCKET IC ST	DIP-1	.300 SEP/.160" PINS/NO INLAY
400	030	016	SOCKET IC ST	DIP-1	.300 SEP/.160" PINS/NO INLAY
400	040	024	SOCKET IC ST	DIP-2	.600 SEP/.160" PINS/NO INLAY
402	030	000	CONNECTOR CO-AXIAL	LEM	
402	030	003	GROUND LUG NONLOCK	LEM	
402	030	004	GROUND STRAP "H"	LEM	
433	220	002	FUSE PICO II 125V	3 AM	
540	203	001	SIDE COVER CAMAC STD (LIP	06DEC85	FAB-K
540	206	078	RAIL CAMAC STD TOP	W/LI	04DEC85 FAB-C
540	206	178	RAIL CAMAC STD BOT	W/LI	04DEC85 FAB-C
540	209	101	REAR PANEL CAMAC	SIZE	04DEC85 FAB-G
555	430	003	CAPTIVE SCREW ASSEMBLY	MOD: KNOB	.500 LONG
712	551	013	PC BD PREASS'Y	255	03DEC85 FAB-D ATW-F
722	551	013	FRONT PNL PREASS'Y	255	18NOV85 FAB-D ATW-B
732	551	012	SIDE CAMAC LEFT	255	18NOV85 FAB-B ATW-A



VOLTAGE PART:			
P.C.	DESIGNATION	±5.3 (GND)	
SN74LS00	SF, SK	14	7
SN74LS01	BA, BC, BE, BH, BL, BM, BN	14	7
SN74LS01	RA, RB, RE, RD, RF, SG, SH	14	7
SN74LS02	BA, BE, BM, SC, SH	14	7
SN74LS04	SF, SK	14	7
SN74LS10	SA	14	7
SN74LS20	SD	14	7
SN74LS37	SL	14	7
SN74LS42	SS	16	8
SN74LS13	SH	14	7
SN74LS112	AA, AC, AE, AH, AL, AN, AR, AS, AT, AV, AW, AX, AY, AZ, BA, BB, BC, BD, BE, BF, BG, BH, BI, BJ, BK, BL, BM, BN, BO, BP, BQ, BR, BS, BT, BU, BV, BW, BX, BY, BZ, CA, CB, CC, CD, CE, CF, CG, CH, CI, CJ, CK, CL, CM, CN, CO, CP, CQ, CR, CS, CT, CU, CV, CW, CX, CY, CZ, DA, DB, DC, DD, DE, DF, DG, DH, DI, DJ, DK, DL, DM, DN, DO, DP, DQ, DR, DS, DT, DU, DV, DW, DX, DY, DZ, EA, EB, EC, ED, EE, EF, EG, EH, EI, EJ, EK, EL, EM, EN, EO, EP, EQ, ER, ES, ET, EU, EV, EW, EX, EY, EZ, FA, FB, FC, FD, FE, FF, FG, FH, FI, FJ, FK, FL, FM, FN, FO, FP, FQ, FR, FS, FT, FU, FV, FW, FX, FY, FZ, GA, GB, GC, GD, GE, GF, GH, GI, GJ, GK, GL, GM, GN, GO, GP, GQ, GR, GS, GT, GU, GV, GW, GX, GY, GZ, HA, HB, HC, HD, HE, HF, HG, HH, HI, HJ, HK, HL, HM, HN, HO, HP, HQ, HR, HS, HT, HU, HV, HW, HX, HY, HZ, IA, IB, IC, ID, IE, IF, IG, IH, II, IJ, IK, IL, IM, IN, IO, IP, IQ, IR, IS, IT, IU, IV, IW, IX, IY, IZ, JA, JB, JC, JD, JE, JF, JG, JH, JI, JJ, JK, JL, JM, JN, JO, JP, JQ, JR, JS, JT, JU, JV, JW, JX, JY, JZ, KA, KB, KC, KD, KE, KF, KG, KH, KI, KJ, KK, KL, KM, KN, KO, KP, KQ, KR, KS, KT, KU, KV, KW, KX, KY, KZ, LA, LB, LC, LD, LE, LF, LG, LH, LI, LJ, LK, LL, LM, LN, LO, LP, LQ, LR, LS, LT, LU, LV, LW, LX, LY, LZ, MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MM, MN, MO, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MY, MZ, NA, NB, NC, ND, NE, NF, NG, NH, NI, NJ, NK, NL, NM, NN, NO, NP, NQ, NR, NS, NT, NU, NV, NW, NX, NY, NZ, OA, OB, OC, OD, OE, OF, OG, OH, OI, OJ, OK, OL, OM, ON, OO, OP, OQ, OR, OS, OT, OU, OV, OW, OX, OY, OZ, PA, PB, PC, PD, PE, PF, PG, PH, PI, PJ, PK, PL, PM, PN, PO, PP, PQ, PR, PS, PT, PU, PV, PW, PX, PY, PZ, QA, QB, QC, QD, QE, QF, QG, QH, QI, QJ, QK, QL, QM, QN, QO, QP, QQ, QR, QS, QT, QU, QV, QW, QX, QY, QZ, RA, RB, RC, RD, RE, RF, RG, RH, RI, RJ, RK, RL, RM, RN, RO, RP, RQ, RR, RS, RT, RU, RV, RW, RX, RY, RZ, SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SK, SL, SM, SN, SO, SP, SQ, SR, SS, ST, SU, SV, SW, SX, SY, SZ, TA, TB, TC, TD, TE, TF, TG, TH, TI, TJ, TK, TL, TM, TN, TO, TP, TQ, TR, TS, TT, TU, TV, TW, TX, TY, TZ, UA, UB, UC, UD, UE, UF, UG, UH, UI, UJ, UK, UL, UM, UN, UO, UP, UQ, UR, US, UT, UY, UZ, VA, VB, VC, VD, VE, VF, VG, VH, VI, VJ, VK, VL, VM, VN, VO, VP, VQ, VR, VS, VT, VU, VV, VW, VX, VY, VZ, WA, WB, WC, WD, WE, WF, WG, WH, WI, WJ, WK, WL, WM, WN, WO, WP, WQ, WR, WS, WT, WU, WV, WW, WX, WY, WZ, XA, XB, XC, XD, XE, XF, XG, XH, XI, XJ, XK, XL, XM, XN, XO, XP, XQ, XR, XS, XT, XU, XV, XW, XX, XY, XZ, YA, YB, YC, YD, YE, YF, YG, YH, YI, YJ, YK, YL, YM, YN, YO, YP, YQ, YR, YS, YT, YU, YV, YW, YX, YY, YZ, ZA, ZB, ZC, ZD, ZE, ZF, ZG, ZH, ZI, ZJ, ZK, ZL, ZM, ZN, ZO, ZP, ZQ, ZR, ZS, ZT, ZU, ZV, ZW, ZX, ZY, ZZ	14	7

NOTES:  
 1. ALL UNMARKED DIODES MAY BE IN/4.  
 2. ADDITIONAL CAPACITORS ON VOLTAGE  
 3. UNUSED DEVICES:

